Comparison of actinic and non-actinic inspection of programmed-defect masks

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The production of defect-free mask blanks for EUV lithography is a central challenge that can only be met if mask inspection tools of unprecedented sensitivity can be created and qualified in time for volume production. Presently, it is an open question whether or not EUV *at-wavelength* inspection tools will be required.

It is well known that the resonant reflectivity of EUV multilayer coatings is highly sensitive to any disturbance of the layer or surface structure: including substrate bumps and pits which cause phase-defects, and absorbing particles or surface material which causes local reflectivity loss. Small critical coating defects may only show up under EUV inspection. For this reason, the cross-calibration testing of non-EUV commercial inspection tools, against measurements made in prototype EUV inspection tools is essential for progress in the field.

We report cross-calibration testing of programmed-defect masks measured in multiple tools using different testing geometries and wavelengths. We have inspected both bump-type substrate defects, and pit defects, and comparisons to printed images are available for some features. For some defects and features EUV sensitivities far surpass the capture efficiency of commercial tools. However recent improvements demonstrated in a prototype tool are encouraging.